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Binder-free Carbon Nanotube Flexible Solid State Supercapacitor[1] KOFI ADU, The Pennsylvania State University-Altoona College, DANHAO MA, The Pennsylvania State University, RAMAKRISHNAN RAJAGOPALAN, The Pennsylvania State University-DuBois, CHENG-YU WANG, ANGELA LUEKING, CLIVE RANDELL, The Pennsylvania State University — We present a post synthesis self-assemble protocol that transforms the trillions of CNTs in powder form into densely packed flexible, robust and binder-free macroscopic membranes with hierarchical pore structure. The binder-free CNT membranes could be as thin as $<10\mu$m with mass density greater than that of water (1.0g/cc). As the thickness of the CNT membrane is increased, we observed a gradual transition from high flexibility to buckling and brittleness in the flexural properties of the CNT membranes. We have demonstrated the use of the CNT membranes as electrode in two-electrode 1M H_2SO_4 aqueous double layer supercapacitor that shows very high power density $\sim$ 1040 kW/kg based on the mass of both electrodes and time constant of $\sim$ 15 ms with no degradation in performance even after 10,000 cycles. Furthermore, we will show the designing of flexible 3-stack bipolar solid-state ultracapacitor and present results on energy/power densities, voltage, cyclability, temperature stability in relation to flexibility and weight. Preliminary results indicate high temperature stability $>85^{\circ}$C and CV voltage $\sim$ 3V with very low leakage current $\sim$ 10nA.

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